REMARKS/ARGUMENTS

Claims 1-44 were pending. Claims 8 and 37 were deleted, accordingly, claims 1-7, 9-36, and 38-44 are now pending.

Claims 18-28 are rejected under 35 U.S.C. 101 and 35 U.S.C. 112, first paragraph. In response, independent claim 18 is amended to more clearly point out that what is recited is not a computer program per se. In particular, claim 18 was amended to recite a memory for a computer system:

> *18. A memory for a computer system including a processor, the memory comprising:*

In response to the rejection of claim 28, claim 28 is amended to more clearly point out what is recited is not an electronic signal or a form of energy. In particular, claim 28 was amended to recite a frame of film:

> *28. A frame of film comprising the image formed according to the method described in claim 1.*

Claims 1-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jenkins (US Patent No. 6,028,608) in view of Cook et al. (US Patent No. 5,025,400. In response, the undersigned respectfully traverses the Examiner's rejections of claims 1-44 as being unpatentable under 35 U.S.C. 103(a).

Embodiments of the present invention relate to methods for smoothly transitioning between different object representations in computer animation incorporating stochastic sampling techniques. Abstract.

In the present patent application, it was described that in computer animation, it was sometimes desirable to use lower resolution models of objects for rendering when such objects appear far away from the viewing plane, for example. Col. 1, l.5-10. However, when such objects move towards the viewer, higher resolutions of models of objects needed to be rendered. Embodiments of the present invention recognize that a problem with such techniques, was that when transitioning between lower resolution models and higher resolution models, the transition of the rendered objects on the screen may result in "popping" visual artifacts. Col. 2, l.1-3.

Embodiments of the present invention are directed towards solving the "popping" problem. Col. 2, l.42-47. As described in the specification, the inventors developed a solution that extended the techniques developed by Pixar with regards to stochastic sampling, as illustrated in U.S. Pat. No. 4,897,806. Col. 2, l.46-55. An illustrative example was illustrated in Figs. 8-10 of the present patent application. In the example, sub-pixel sampling locations are shown within a pixel in Fig. 8. In Fig. 9, one of the sampling locations is illustrated as being associated with a simplified geometric model of an object, and in Fig. 10, one of the sampling locations is illustrated as being associated with a more complex geometric model of the object:

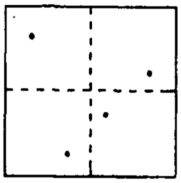


Fig.8

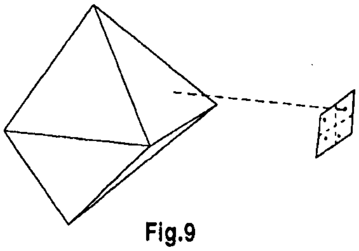


Fig.9

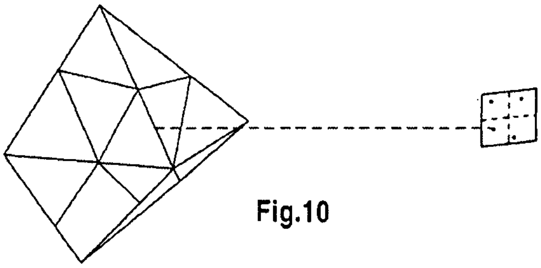
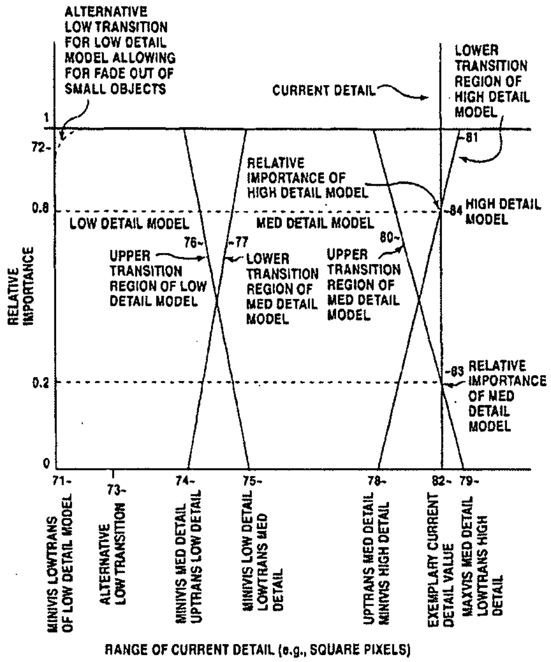


Fig.10

As was also illustrated in Fig. 7, the proportion of sub-pixel sampling locations associated with a high resolution model (e.g. Fig. 10), to a low resolution model (e.g. Fig. 9) may depend upon the "relative importance" of the object, (e.g. the screen size of the object, importance of the object, viewing angle, angle, etc. col. 2,l.64-col.3,l.2, col. 7,l.17-31), as illustrated below:

Fig.7



Embodiments of the present invention are directed towards these features. For example, claim 1, as amended, recites:

> *selecting a plurality of sample locations within an area of a pixel of an image; wherein said sample locations are pseudorandomly distributed within said area of said pixel;*
>
> *associating with each of said sample locations one of said plurality of different representations;*
>
> *computing an image contribution at each of said sample locations based on the associated one of said plurality of different representations; and*

Claim 1 is not obvious under 35 U.S.C. 103(a) by Jenkins in view of Cook. More specifically, it would not have been obvious to combine Jenkins and Cook.

Jenkins relates to a hardware and software method for reducing the amount of data displayed data to a user. More specifically, Jenkins discloses techniques to reduce the amount of graphical data computed and displayed to a viewer, based upon the physiology of the eye - including how the viewers sense contrast with respect to spatial frequency, col.1, l.31-55.

As such, Jenkins is very concerned about where a viewer is currently looking at on an image and the velocity of the viewer's eyes across the image. See, e.g. Fig. 8, Figs. 13A-D. Generally, Jenkins discloses regions where the viewer is viewing will have a greater number of sampling locations, and the periphery regions will have a fewer number of sampling locations.

In Jenkins, the adaptive sampling techniques are used to determine sampling locations, as illustrated in Figs. 1E-F, Fig. 9A-B, Col. 27, ll-5. In brief, in Figs. 9A-B, the determination whether to perform additional sampling (adaptive sampling) is made based upon visible contrast between sampling locations. In step 900, an intersample contrast is initially determined for a sample location between two locations. Col. 27, l.6-8. In Figs 9A-B, if the visible contrast between is below a threshold, step 905, then no further sampling is performed between the two sample locations, step 970. Col.27,l.14-20. After adjustment for physiology of the eye, step 910, the contrast value is again compared against a threshold, step 915.

Notably, the specification of the sampling locations are very carefully selected. As illustrated in steps 920 and 930, in Figs. 9A-B, the sampling location (K1, K2) between the two sample locations is adjusted, and in steps 925 and 935, and the contrast values are compared against a threshold. Further refinement as to the sampling location (K1, K2) occurs in steps 940, 950 and 960, and the contrast values are compared against a threshold in steps 945, 955, 965, and 975. As is discussed in Jenkins, the contrast adjustments factor-in human physiology, step 910; exposure duration, step 920; focal plane and sample depth, step 930; eye velocity, steps 940 and 950; and retinal eccentricity, step 960. In Jenkins, adaptive sampling is performed on an image as illustrated in Figs. 1E-F. Col. 27, ll-5. In steps 998 and 999, a representation of an object stored in a level-of-detail database is selected, if further sampling is desired.

It is not obvious to one of ordinary skill in the art to combine Jenkins and Cook. As was discussed above, Jenkins disclosed an adaptive sampling methodology where the sampling locations are precisely selected. More specifically, Jenkins disclosed a process where sample locations were carefully selected such that a greater number of sample locations are selected in regions where there is a high contrast and in regions where the viewer is viewing. The precise location of sampling were defined by the variables K1 and K2 (distances from two existing locations) in steps 920, 930, 940, 950 and 960. For example, step 920 modified K1 and

K2 based on "exposure duration," step 930 modified K1 and K2 based upon "focal plane and sample depth, step 940 modified K1 and K2 based upon acceleration or velocity, and the like. Thus, it can be seen that Jenkins was very careful and deliberate in selecting sampling location. Further, based upon the precise computation of K1 and K2, the specific level-of-detail model would be defined in Jenkins.

In direct contrast, to Jenkins, Cook discloses a sampling system in which some sampling locations in an image are pseudo-randomly selected. As stated in Cook, various embodiments were directed to reducing the problem of aliasing in an image by randomly sampling points in space, and time. Abstract. Typical applications are described in Cook, including depth of field, effects of illumination, shadows, object reflection, and object refraction. Abstract. Cook, however, makes no mention about pseudo randomly selecting between different levels-of-detail of objects.

One skilled in the art would not considered combining Jenkins and Cook, as the combination would have clearly frustrated the purpose of Jenkins. As discussed above, Jenkins disclosed a very precise algorithm for selecting sampling locations (K1 and K2) and selecting level-of-detail algorithms based upon the sampling locations. If the teaching of pseudo-random sampling of Cook were imported into Jenkins, the precise algorithm and computations disclosed in Jenkins Figs. 9A-B, etc. would all be rendered completely superfluous. In such a case, the combination of Jenkins and Cook would be improper.

In light of at least the above, claim 1, as amended, is not obvious under 35 U.S.C. 103(a) by Jenkins in view of Cook.

Claims 2-7, 9-17, 28 and 40-44 are asserted to be allowable for substantially the same reasons as claim 1, and more specifically, for the specific limitations they recite.

Independent claims 18 and 29, are asserted to be allowable for substantially the same reasons discussed above, and more specifically, for the specific limitations they recite.

Claims 19-27 are asserted to be allowable for substantially the same reasons as claim 18, and more specifically, for the specific limitations they recite.

Claims 30-39, are asserted to be allowable for substantially the same reasons as claim 29, and more specifically, for the specific limitations they recite.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,

/Stephen Y. Pang/

Stephen Y. Pang
Reg. No. 38,575

TOWNSEND and TOWNSEND and CREW LLP
Two Embarcadero Center, Eighth Floor
San Francisco, California 94111-3834
Tel: 650-326-2400 Fax: 415-576-0300
SYP:djb
61717668 v1